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The real life scenario for diffusion of renewable energy technologies (RETs) in Pakistan – Lessons learned through the pilot field study under physical community

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ABSTRACT

In Pakistan less or almost no work has been reported, which investigated the response of local people in a physical community regarding the diffusion and acceptance of renewable energy technologies (RETs). In order to identify the ground realities, this research has undertaken this task by conducting a pilot field study, which not only provides the response of physical community for RET but also identified the main hurdles in RET diffusion in Pakistan. This paper is an extension of our earlier research work in which the root causes responsible for dilemmas in Pakistan's policies were identified for the cause of sustainable development through renewable energy.

Contents

1. Introduction

Pakistan faces, acute shortage of energy representing weak pattern for its energy creation. Power cut off is just an indication of the severity of crises. Being poor, Pakistan spends 3 Billion US dollars per year to import oil to meet its energy requirements and this ratio is growing annually with 1% [1]. In this scenario Chaudry [2] suggest that only two choices are left for the policy makers, that either to adopt the traditional strategy to rely on the fossil fuel based energy or to adopt the abundance availability of natural renewable energy sources. In policies, Pakistan has set promising targets to achieve its energy demands through renewable, e.g. ...... the objective of Pakistan is to achieve 10% of state electricity generation obtained from renewable resources by 2010 [3] but in reality the proposed target seems fogy. 2010 is about to pass but the pace to accelerate the renewable energy technologies to generate electricity is very slow. Pakistan is located at equator. Its majority areas

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are sunny and sunshine between 7 and 8 h daily or approximately 2300–2700 h per annum falls [4]. The countries located on this line are receiving maximum amount of sunlight, which can be tapped for household and commercial purposes. Therefore the pilot field study investigates the researcher quest as it will try to answer that "why solar energy based technologies are not commercialized in Pakistan"? despite of availability of sun and the need of the off grid technologies in the context of energy crises.

Introduction of new technologies in a society is a complex issue. The search for optimal patterns of renewable energy generation, conversion and transmission under the least economic cost is the major concern for the decision makers. Management of renewable energy system (RES) has complex interactions with many components of a community, such as environment, ecosystem and socio-economy [5]. Therefore at this stage in order to find real facts regarding the diffusion of renewable energy technologies (RETs) focus was given to simple solar thermal technologies (STTs) among the bulk of other RETs. These technologies are simpler/easy to use, can be manufactured locally and have tendency to do variety of tasks related with the heating mechanisms. Since no photovoltaic (PV) system is involved in their manufacturing there cost is low. The photovoltaic (PV) technology for the generation of electricity also has a huge potential in Pakistan and is ideal for off gird generation of electricity to remote areas but the work done by Khan [6] refers the scope for the diffusion of PV technology as "heartening developments". Another major reason for the selection of STTs lies in the fact that common people in Pakistan are entirely unaware even about the uses of RET. In our earlier research . . .. . . It was observed that 69% of all stakeholders did not have any knowledge about the application of solar thermal devices [7], which are considered as most simple form of technologies in other forms of RETs. Now a pilot field study has been done among the local population in order to find the diffusion capabilities of RETs in the shape of STTs on real grounds.

2. Pilot field study in a physical community

Pakistan's conventional energy resources are shrinking day by day. Therefore it became essential to utilize alternate energy resources instead of the conventional energy resources to meet the routine energy based requirements of common people to facilitate their daily activities of life. Pakistan is rich in agriculture-based resources in particular. The commodities residing in rural/sub-urban locations have limited access to technologies for the value-addition to their agriculture produce. These inevitable forces compel them to sell their raw resources at extremely low cost. Most of the rural population is either unaware of the potential that remains untapped through cottage scale industrial processing of their produce or find it difficult to benefit from the technical facilities available at big cities, being far away in distance from their abodes. Several commodities, being perishable in nature, cannot be bulk transported to the industrial cities, as it is neither efficient nor economical. This scenario presents a unique opportunity to encourage the concept of "Village-Head Technologies" [8]. The possibilities of the technological development in the rural areas of Pakistan will need special focus. This will not only develop the region socially as well as economically but will also become a source of national growth through enhanced GDP. Thus the concept of utilizing the RETs in the form of STTs in our society is an innovative concept, which will provide an alternative mean for economic growth and poverty alleviation. The pilot field study on one hand will be first of its kind to see the socio-economic impact of RETs in our society through the use of STTs but on the other hand in longer run tries to analyze the functioning and linkages of research and scientific organizations working in the area of renewable energy with other organization working for the cause of poverty alleviation, community mobilization and the economic generation to identify the diffusion capabilities of RETs in real life scenario. As the main focus of the study in long run is to provide trajectories to mobilize all components existing individually to combine and work as a single entity to achieve the common goal, i.e. the diffusion of RETs.



Fig. 1. Map of Pakistan Study, highlighted area showing district Khairpurmirus.

2.1. Location

The pilot filed study was conducted in a small physical community at District Khairpur's village of Gul Mohammad Jamro, 7 km away from District Ranipur, famous for dates palm cultivation. The location of pilot field study is represented in Figs. 1 and 2, respectively. The reason behind the selection of this particular location and food commodity is due to the fact that Pakistan is considered as one of the largest dates growing region of the world and largest dates exporter after India and UAE and it produces 11% share of the total global production of the dates. The share of the Sindh province (Sukkur and Khairpurmiurs) is the largest in Pakistan, where a large amount of dates palm are being damaged due to centuries old drying techniques (Fig. 3).

2.2. Methodology

Absence of application of appropriate technologies (methods) to achieve the economic growth through exploitation of local natural and human resources is common approach [9]. For a pilot study, a technology known as solar dehydrator represented in Fig. 4 was introduced in a small community, which best suited the definition of appropriate technology as it is cheap, environmental friendly, indigenous and easy to operate/maintain. In pilot field study the dates palm were dried in solar dehydrator, which traditionally



Fig. 2. Location of the field.



Fig. 3. Open space drying.

are being dried in open space. The open space drying and drying through solar dehydrator are represented in Figs. 3 and 4, respectively.

3. Lesson learned through the pilot field study under physical community

The pilot case study became the launching pad to understand the diffusion capabilities of RETs at micro level of society in Pakistan. Through the pilot field study the identified factors also points towards the existing condition of the techno-economics dynamics for RETs in our society. The factors identified are discussed in details below:

3.1. Absence of linkages among organizations

During the pilot study it was observed that there exists weaker or even absence of linkages among the various stakeholders/institutes, which are essential pillars for technology transfer such as universities, R&D institutes, chambers of commerce & industries, poverty reduction agencies and institutes developed for technology transfer. In a country when there is almost no network for diffusion of RETs, the chances to utilize its potential become very low. There are many factors which can be identified and needed to be researched but the most obvious one is the lack of policy measures, which can bring all these stakeholders to become one entity and to work on a single platform. Due to absence of which, common people are suffering much to take any advantage from RETs to increase their income generating opportunities and alleviate poverty.



Fig. 4. Dates drying through solar dehydrator.



Fig. 5. During the filed study.

3.2. Identification of policy flaws

From the pilot study, it is found that the provincial as well as the national policies of Pakistan of poverty alleviation and science & technology had given no or less importance to utilize the communities' potentials in achieving the economic growth through the use of sustainable technologies. In Pakistan, this approach can be of viable importance by keeping in view the increasing manpower and efficiency of technologies to yield better quality products, which are sustainable in nature. Currently, the said approach is missed by the institute responsible for setting Pakistan's S&T vision and priorities. As far as policy documents are concerned, this research identified only one project titled "Commercialization of Solar Devices and Technologies" in National Technology Policy (1993) of Pakistan, which giving emphasis to the involvement of local people in utilizing RETs. The project was proposed by an institute named Pakistan Council of Scientific & Industrial Research (PCSIR-Solar Energy Research Centre) now known as PCSIR laboratories, Hyderabad.

3.3. Techno-economic advantages of solar dehydrator

The results for dates drying through solar dehydrator were very impressive. It did not utilize any electricity in processing of drying and yields better quality dates. The same is summarized in Table 1.

3.4. Recognition and in-depth understanding of the techno-economic dynamics of Pakistan

Despite of strong potential for dates drying through solar dehydrator and acceptance of technology by the local community (Figs. 5 and 6) raising funds were not possible to extend this

Table 1
Advantages of solar dehydrator.

Properties	Traditional drying	Solar dehydrator
Time factor	05–06 days	02–03 days
Quality	Low	High
Wastages	High	Low
Test	Less sweet	High sweet
Color	Light brown	Dark goldish brown



Fig. 6. The researcher with local community.

research work. No recognition was achieved within Pakistan to materialize the advantages observed through the pilot field study for dates drying for common people. On meeting through various funding agencies in government sector it was identified that there is no provision to support such projects involving local communities in utilizing RETs. In Pakistan, less priority has been given to initiate such projects. The same can be visualized from absence of community based technological projects in majority of government institutes on going development projects. After completing the field study the recommendations were sent to various governmental departments to introduce these technologies in different communities. Some of the bureaucrats and politicians were motivated enough to adopt such technologies but due to transfer/posting of bureaucrats and engagement of politicians in other activities.

3.5. Advantage taken from the pilot field study outcomes

Due to absence of policies in government setup to promote the community participation for utilizing technologies to achieve economic growth and to alleviate poverty alleviation, no results were obtained for common people through the pilot field study. Where as, by knowing the importance of solar dehydrators a private industrial party known as M/s National Food (Pvt) Ltd., Pakistan approached us and used the technologies for chili drying. The private party is generating handsome money by exporting the dried chili powder from the use of said technology but the impact of the said technology did not reached to the common people due to poor or absence of any dynamics of techno-economic at the micro level of the society in Pakistan.

3.6. Current impact of renewable energy technologies to common population

Through the field study it was learned that almost no impact of renewable energy technologies have been reached to the doors of larger population in Pakistan as very few initiatives for renewable energy resources have been reported involving local people.

4. Conclusion

The pilot field study identified factors such as absence of linkages, policy flaws at regional and domestic level to utilize community potential keeping in view the economic viability of RETs. Lack of funding to commercialize these technologies is a major hurdle in diffusion of these technologies. The pilot field study also identified that the private organizations are ready to take advantages from RETs. However, the local population remained unable to avail any profit from such research outputs. In Pakistan, much work is needed to be done for the diffusion of RETs among the common people.

5. Recommendations

(1) Pakistan needs to restructure its organizations setup to create better linkages for the promotion of RE.
(2) Funding should be provided to organizations to uptake more community based RE projects.
(3) Awareness programs on RE should be launched on priority basis.

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